# Covering a few more SQL Topics

# Module 2 Notes Continued - Part 2

**student**

| Rollno | coursecode | student_name | semester |
|---|---|---|---|
| 101 | CSEN1001 | AAA | 5 |
| 101 | CSEN2061 | AAA | 5 |
| 102 | CSEN1001 | BBB | 5 |
| 103 | CSEN2061 | BBB | 5 |
| 103 | CSEN3061 | BBB | 5 |

**course**

| course_id | course_title |
|---|---|
| CSEN1001 | Python Programming |
| CSEN2061 | DBMS |
| CSEN3061 | Machine Learning |

## Enforcing 'Constraints' using Create Command

### On the 'student' table

SQL> create table student(rollno number(3), coursecode varchar2(8), student_name varchar2(5) not null, semester number(1), constraint pk2_rollno_coursecode primary key(rollno,coursecode), constraint ck2_semeter check(semester between 1 and 8), constraint fk2_coursecode foreign key(coursecode) references course(course_id));

### On the 'course' table

SQL> create table course(course_id varchar2(8), course_title varchar2(30), constraint pk1_course_id primary key(course_id), constraint uk1_course_title unique(course_title));

## SQL Distinct Clause

```
SQL> select * from employee;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                      100000 10-JAN-92          1
       101 BBB                      120000 10-FEB-92          1
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2

8 rows selected.

SQL> select distinct(salary) from employee;

    SALARY
----------
    100000
    220000
    125000
    230000
    225000
    120000

6 rows selected.

SQL> select distinct(deptno) from employee;

    DEPTNO
----------
         1
         2
         3
```

## SQL Operators

- **Arithmetic Operators - +, -, *, / and %**

```
SQL> select salary from employee;

    SALARY
----------
    100000
    120000
    125000
    225000
    220000
    230000
    230000
    230000

8 rows selected.

SQL> select salary+1000 from employee;

SALARY+1000
-----------
     101000
     121000
     126000
     226000
     221000
     231000
     231000
     231000

8 rows selected.

SQL> select salary-1000 from employee;

SALARY-1000
-----------
      99000
     119000
     124000
     224000
     219000
     229000
     229000
     229000

8 rows selected.

SQL> select salary*10 from employee;

 SALARY*10
----------
   1000000
   1200000
   1250000
   2250000
   2200000
   2300000
   2300000
   2300000

8 rows selected.

SQL> select salary/2 from employee;

  SALARY/2
----------
     50000
     60000
     62500
    112500
    110000
    115000
    115000
    115000

8 rows selected.
```

- **Relational Operators - =,<>,<,<=,>,>=**

```
SQL> select salary from employee;

    SALARY
----------
    100000
    120000
    125000
    225000
    220000
    230000
    230000
    230000

8 rows selected.

SQL> select * from employee where salary=120000;

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       101 BBB                      120000 10-FEB-92          1

SQL> select * from employee where salary<>120000;

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                      100000 10-JAN-92          1
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2

7 rows selected.
```

```
SQL> select * from employee where salary!=120000;

     EMPNO ENAME                    SALARY DOB        DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                    100000 10-JAN-92          1
       102 CCC                    125000 10-MAR-92          2
       103 DDD                    225000 10-APR-92          2
       104 EEE                    220000 10-MAY-92          3
       105 FFF                    230000 10-JUN-92          3
       106 GGG                    230000 10-JUL-92          2
       107 HHH                    230000 10-JUN-92          2

7 rows selected.

SQL> select * from employee where salary>120000;

     EMPNO ENAME                    SALARY DOB        DEPTNO
---------- -------------------- ---------- --------- ----------
       102 CCC                    125000 10-MAR-92          2
       103 DDD                    225000 10-APR-92          2
       104 EEE                    220000 10-MAY-92          3
       105 FFF                    230000 10-JUN-92          3
       106 GGG                    230000 10-JUL-92          2
       107 HHH                    230000 10-JUN-92          2

6 rows selected.

SQL> select * from employee where salary>=120000;

     EMPNO ENAME                    SALARY DOB        DEPTNO
---------- -------------------- ---------- --------- ----------
       101 BBB                    120000 10-FEB-92          1
       102 CCC                    125000 10-MAR-92          2
       103 DDD                    225000 10-APR-92          2
       104 EEE                    220000 10-MAY-92          3
       105 FFF                    230000 10-JUN-92          3
       106 GGG                    230000 10-JUL-92          2
       107 HHH                    230000 10-JUN-92          2

7 rows selected.
```

- **Logical Operators – not, or, and**

```
SQL> select * from employee where not(deptno=1);

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2

6 rows selected.

SQL> select * from employee where not(deptno=1) or salary>=230000;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2

6 rows selected.

SQL> select * from employee where not(deptno=1) and salary>=230000;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
```

- **Like Operator (Pattern Matching)**

SQL> select * from employee;

```
   EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                    100000 10-JAN-92          1
       101 BBB                    120000 10-FEB-92          1
       102 CCC                    125000 10-MAR-92          2
       103 DDD                    225000 10-APR-92          2
       104 EEE                    220000 10-MAY-92          3
       105 FFF                    230000 10-JUN-92          3
       106 GGG                    230000 10-JUL-92          2
       107 HHH                    230000 10-JUN-92          2
       108 Ramana                 180000 10-FEB-93          2
       109 Ramesh                 180000 10-FEB-93          3
       110 Ratan                  280000 10-MAR-93          1
       111 Rajan                  250000 10-APR-93          1
```

SQL> select * from employee where ename like 'R%';

```
   EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       108 Ramana                 180000 10-FEB-93          2
       109 Ramesh                 180000 10-FEB-93          3
       110 Ratan                  280000 10-MAR-93          1
       111 Rajan                  250000 10-APR-93          1
```

SQL> select * from employee where ename like 'Ram%';

```
   EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       108 Ramana                 180000 10-FEB-93          2
```

```
      109 Ramesh                180000 10-FEB-93        3

SQL> select * from employee where ename like '%n';

    EMPNO ENAME                SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
      110 Ratan                280000 10-MAR-93        1
      111 Rajan                250000 10-APR-93        1

SQL> select * from employee where ename like '______';  // names having 6 letters
// 6 underscore symbols are used to match that pattern

    EMPNO ENAME                SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
      108 Ramana               180000 10-FEB-93        2
      109 Ramesh               180000 10-FEB-93        3

SQL> select * from employee where ename like '___'; // names having 3 letters
// 3 underscore symbols are used to match that pattern


    EMPNO ENAME                SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
      100 AAA                  100000 10-JAN-92        1
      101 BBB                  120000 10-FEB-92        1
      102 CCC                  125000 10-MAR-92        2
      103 DDD                  225000 10-APR-92        2
      104 EEE                  220000 10-MAY-92        3
      105 FFF                  230000 10-JUN-92        3
      106 GGG                  230000 10-JUL-92        2
      107 HHH                  230000 10-JUN-92        2

SQL> select * from employee where ename like '_a%'; // names having second letter
'a'

    EMPNO ENAME                SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
      108 Ramana               180000 10-FEB-93        2
      109 Ramesh               180000 10-FEB-93        3
      110 Ratan                280000 10-MAR-93        1
      111 Rajan                250000 10-APR-93        1
```

SQL> select * from employee where ename like '%a_'; // names having last but one letter as ‘a’

```
     EMPNO ENAME                    SALARY DOB          DEPTNO
---------- -------------------- ---------- --------- ----------
       110 Ratan                    280000 10-MAR-93          1
       111 Rajan                    250000 10-APR-93          1
```

https://www.programiz.com/sql/operators

## SQL Functions

- Built-in Functions - https://www.w3schools.com/sql/sql_ref_sqlserver.asp

### Numeric Functions

```
SQL> select ceil(14.5) from dual;
CEIL(14.5)
----------
        15
SQL> select floor(14.5) from dual;
FLOOR(14.5)
-----------
         14
SQL> select abs(-14.5) from dual;
ABS(-14.5)
----------
      14.5
SQL> select power(2,2) from dual;
POWER(2,2)
----------
         4
SQL> select power(2,3) from dual;
POWER(2,3)
----------
         8
```

## String Functions

https://www.programiz.com/sql/operators

https://www.oracletutorial.com/oracle-string-functions/ -Best site

concat()

```
SQL> select concat('ab','c') from dual;
CON
---
abc
```

```
SQL> select ascii('A') from dual;
ASCII('A')
----------
        65
```

chr()

```
SQL> select chr('65') from dual;
C
-
A
```

instr()

```
SQL> select instr('GITAM University','AM') from dual;

INSTR('GITAMUNIVERSITY','AM')
-----------------------------
                            4
```

lpad/rpad

```
SQL> select lpad('ABC',5,'*') from dual;

LPAD(
-----
**ABC
```

```
SQL> select ltrim(' abc ') from dual;

LTRI
----
abc
```

```
SQL> select rtrim(' abc ') from dual;
```

```
RTRI
----
 abc
SQL> select replace('GITAM','G','P') from dual;

REPLA
-----
PITAM
SQL> select replace('MADAM','M','R') from dual;

REPLA
-----
RADAR

SQL> select length('GITAM University') from dual;

LENGTH('GITAMUNIVERSITY')
-------------------------
                       16

SQL> select lower(ename) from employee;

LOWER(ENAME)
--------------------
aaa
bbb
ccc
ddd
eee
fff
ggg
hhh
ramana
ramesh
ratan
rajan

SQL> select upper(ename) from employee;

UPPER(ENAME)
```

```
--------------------
AAA
BBB
CCC
DDD
EEE
FFF
GGG
HHH
RAMANA
RAMESH
RATAN
RAJAN

SQL> select initcap(ename) from employee;

INITCAP(ENAME)
--------------------
Aaa
Bbb
Ccc
Ddd
Eee
Fff
Ggg
Hhh
Ramana
Ramesh
Ratan
Rajan

SQL> select length(ename) from employee;

LENGTH(ENAME)
-------------
            3
            3
            3
            3
            3
```

```
         3
         3
         3
         6
         6
         5
         5
```

## ‘in’ or ‘not in’ operator

```
SQL> select * from employee where deptno in (1,3);

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                      100000 10-JAN-92          1
       101 BBB                      120000 10-FEB-92          1
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       109 Ramesh                   180000 10-FEB-93          3
       110 Ratan                    280000 10-MAR-93          1
       111 Rajan                    250000 10-APR-93          1

SQL> select * from employee where deptno not in (1,3);

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
       108 Ramana                   180000 10-FEB-93          2
```

## ‘between’ operator

```
SQL> select * from employee where salary between 200000 and 250000;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
       111 Rajan                    250000 10-APR-93          1
```

```
SQL> select * from employee where salary between 220000 and 230000;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
```

```
SQL> select * from employee where empno between 105 and 107;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
```

## ‘order by’ clause in SQL

Records are display either in asc or desc order of the values of that column

```
SQL> select * from employee order by salary;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                      100000 10-JAN-92          1
       101 BBB                      120000 10-FEB-92          1
       102 CCC                      125000 10-MAR-92          2
       104 EEE                      220000 10-MAY-92          3
       103 DDD                      225000 10-APR-92          2
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2

8 rows selected.

SQL> select * from employee order by salary desc;

     EMPNO ENAME                    SALARY DOB         DEPTNO
---------- -------------------- ---------- --------- ----------
       106 GGG                      230000 10-JUL-92          2
       105 FFF                      230000 10-JUN-92          3
       107 HHH                      230000 10-JUN-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       102 CCC                      125000 10-MAR-92          2
       101 BBB                      120000 10-FEB-92          1
       100 AAA                      100000 10-JAN-92          1

8 rows selected.
```

## Logical Operators- NOT/AND/OR

```
SQL> select * from employee;

     EMPNO ENAME                    SALARY DOB          DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                  100000 10-JAN-92         1
       101 BBB                  120000 10-FEB-92         1
       102 CCC                  125000 10-MAR-92         2
       103 DDD                  225000 10-APR-92         2
       104 EEE                  220000 10-MAY-92         3
       105 FFF                  230000 10-JUN-92         3
       106 GGG                  230000 10-JUL-92         2
       107 HHH                  230000 10-JUN-92         2
       108 Ramana               180000 10-FEB-93         2
       109 Ramesh               180000 10-FEB-93         3
       110 Ratan                280000 10-MAR-93         1
       111 Rajan                250000 10-APR-93         1


SQL> select * from employee where not(deptno=1);
     EMPNO ENAME                    SALARY DOB          DEPTNO
---------- -------------------- ---------- --------- ----------
       102 CCC                  125000 10-MAR-92         2
       103 DDD                  225000 10-APR-92         2
       104 EEE                  220000 10-MAY-92         3
       105 FFF                  230000 10-JUN-92         3
       106 GGG                  230000 10-JUL-92         2
       107 HHH                  230000 10-JUN-92         2
       108 Ramana               180000 10-FEB-93         2
       109 Ramesh               180000 10-FEB-93         3

8 rows selected.

SQL> select * from employee where not(deptno=1) and salary=250000;

no rows selected

SQL> select * from employee where not(deptno=1) or salary=250000;

     EMPNO ENAME                    SALARY DOB          DEPTNO
```

```
---------- -------------------- ---------- --------- ----------
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
       108 Ramana                   180000 10-FEB-93          2
       109 Ramesh                   180000 10-FEB-93          3
       111 Rajan                    250000 10-APR-93          1

9 rows selected.

SQL> select * from employee where not(deptno=2) and salary=250000;

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       111 Rajan                    250000 10-APR-93          1
```

## Date Functions

https://www.oracletutorial.com/oracle-date-functions/

```
SQL> select current_date from dual;

CURRENT_D
---------
13-AUG-25

SQL> select sysdate from dual;

SYSDATE
---------
13-AUG-25


SQL> select current_timestamp from dual;

CURRENT_TIMESTAMP
---------------------------------------------------------------------------
13-AUG-25 09.13.19.389000 AM +05:30
SQL> select last_day(sysdate) from dual;
```

```
LAST_DAY(
---------
31-AUG-25

SQL> select next_day(sysdate,'wednesday') from dual;

NEXT_DAY(
---------
20-AUG-25


SQL> select extract(day from sysdate) from dual;

EXTRACT(DAYFROMSYSDATE)
-----------------------
                     13

SQL> select extract(month from sysdate) from dual;

EXTRACT(MONTHFROMSYSDATE)
-------------------------
                        8
SQL> select extract(year from sysdate) from dual;

EXTRACT(YEARFROMSYSDATE)
------------------------
                    2025
SQL> select add_months(sysdate,3) from dual;

ADD_MONTH
---------
13-NOV-25

SQL> select months_between('01-aug-2025','01-nov-2025') from dual;

MONTHS_BETWEEN('01-AUG-2025','01-NOV-2025')
-------------------------------------------
                                         -3

SQL> select months_between('01-nov-2025', '01-aug-2025') from dual;

MONTHS_BETWEEN('01-NOV-2025','01-AUG-2025')
-------------------------------------------
                                          3
```

## DCL (Data Control Language) Commands

1. **GRANT:** Use this command to give specific users certain permissions, like giving a user permission to read or modify data in a table.

1**GRANT SELECT**, **INSERT ON** Employees **TO** HR_Manager;

This grants the "HR_Manager" role the privileges to select and insert data into the "Employees" table.

2. **REVOKE:** This command is used to remove previously granted permissions from users. You can REVOKE their authorization if you don't want the user to access specific data.

1**REVOKE DELETE ON** Customers **FROM** Sales_Team;

This revokes the privilege to delete data from the "Customers" table from the "Sales_Team" role.

DCL commands are essential for keeping your database secure and ensuring only the right people can access or change the data.

## TCL (Transaction Control Language) Commands

```
SQL> select * from employee;

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                      100000 10-JAN-92          1
       101 BBB                      120000 10-FEB-92          1
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
       200 aaaaaaa                  210000 10-FEB-95          2

9 rows selected.

SQL> savepoint save1;

Savepoint created.
```

```
SQL> delete from employee where deptno=1;

2 rows deleted.

SQL> select * from employee;

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
       200 aaaaaaa                  210000 10-FEB-95          2

7 rows selected.

SQL> rollback to save1;

Rollback complete.

SQL> select * from employee;

     EMPNO ENAME                    SALARY DOB           DEPTNO
---------- -------------------- ---------- --------- ----------
       100 AAA                      100000 10-JAN-92          1
       101 BBB                      120000 10-FEB-92          1
       102 CCC                      125000 10-MAR-92          2
       103 DDD                      225000 10-APR-92          2
       104 EEE                      220000 10-MAY-92          3
       105 FFF                      230000 10-JUN-92          3
       106 GGG                      230000 10-JUL-92          2
       107 HHH                      230000 10-JUN-92          2
       200 aaaaaaa                  210000 10-FEB-95          2

9 rows selected.
```

## Scenario to ER Diagram. Mapping ER Diagram into Relational Model (Tables) (Converting ER Diagram into Tables).

https://medium.com/@kumarjai2466/er-to-relational-mapping-ac84b3c9f258

### Mapping the above ER Diagram into a Relational Model (Tables)

**Steps involved in ER to Relational Mapping:**

**1. Mapping Regular (Strong) Entity Types:**

- For each regular entity type in the ER diagram, create a corresponding table in the relational schema.
- Include all simple attributes of the entity as columns in the table.
- Choose a primary key from the entity's attributes, ensuring it uniquely identifies each record.
- If a composite attribute (an attribute composed of multiple sub-attributes) exists, break it down into its constituent simple attributes and include them as separate columns.

**2. Mapping Weak Entity Types:**

- Create a table for each weak entity type.
- Include all its simple attributes as columns in the table.
- Add the primary key(s) of the owner entity as foreign key(s) in the weak entity's table.
- The primary key of the weak entity is a combination of the primary key(s) of the owner entity and the weak entity's partial key (the attribute(s) that help to uniquely identify the weak entity within the context of its owner).

**3. Mapping Relationship Types:**

- **1:1 Relationships:**
  - **Foreign Key:** Choose one of the participating entities and include the primary key of the other entity as a foreign key in its table.
- **1:N Relationships:** Include the primary key of the entity on the "1" side as a foreign key in the table of the entity on the "N" side.

- **M:N Relationships**: Create a separate table (relationship table) to represent the relationship.
    - Include the primary keys of both participating entities as foreign keys in this table.
    - If the relationship has its own attributes, include them as columns in the relationship table.

**4. Multi-valued Attributes**: Create a separate table for the multi-valued attribute, with a foreign key to the entity it belongs to and the multi-valued attribute itself as a column.

**5. N-ary Relationships**: Create a separate table for the relationship, with foreign keys to all participating entities and any attributes of the relationship itself.

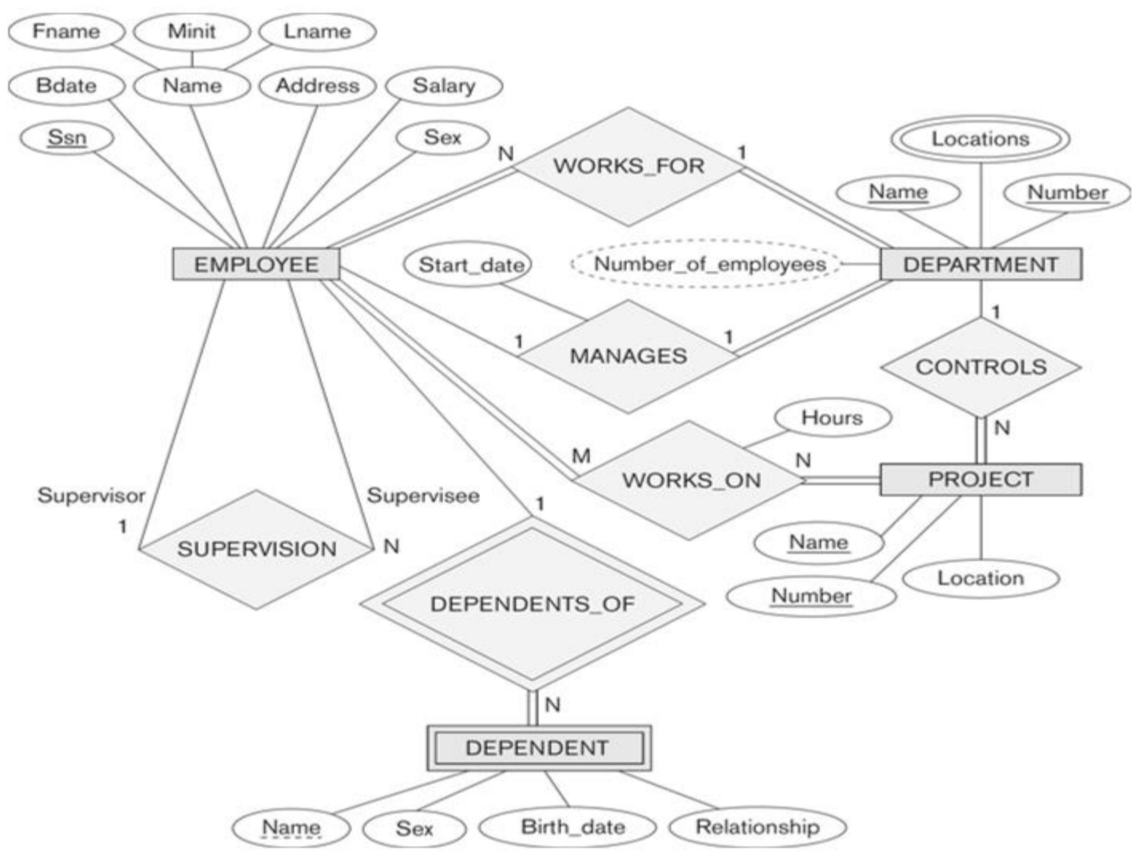
## Example 1:

## Company Database Scenario

A company database tracks **EMPLOYEE** (SSN, Name (Fname, Mint, Lname), Address, Bdate, Salary, Sex, Hire_date, Experience—derived from hire date, Age-derived from Bdate) who work in **DEPARTMENT** (Number, Name, Locations). Each department is **MANAGED by** one of its employees since some start_date, and every employee must **WORK_FOR** one department (**total participation**, many-to-one). Employees work on multiple **PROJECTS** (Project_ID, name, start_date, status), and each project involves many employees, forming a **many-to-many relationship** via **WORKS_ON** (with attributes like hours). Each employee may have multiple **DEPENDENTS** (Name, DOB, relationship), a **weak entity** identified by Employee, forming an **identifying relationship DEPENDENTS_OF** with total participation on **DEPENDENTS**. One employee **SUPERVISES** other employees (**recursive or unary relationship**). Each project is **controlled by** a department.

This scenario includes key ER concepts such as **weak entities**, **different types of attributes, identifying relationships**, **cardinality**, and **total/partial participation**, and enabling complete ER modelling. Draw an ER diagram for this scenario.

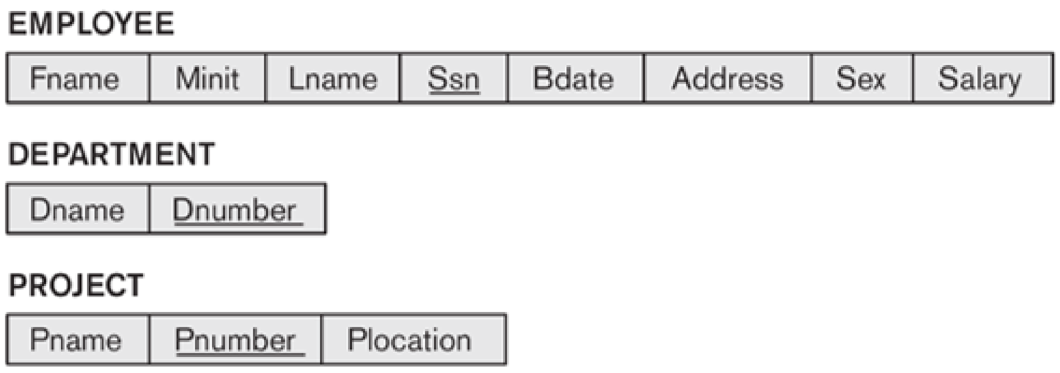
## Example ERD



**Mapping ER Diagram of Company Database into Relational Model (Tables):** See the class or running notes for this.

### 1. Entity Sets

### 1.1 Strong/Regular Entity Sets Tables



EMPLOYEE

| Fname | Minit | Lname | Ssn | Bdate | Address | Sex | Salary |
|---|---|---|---|---|---|---|---|

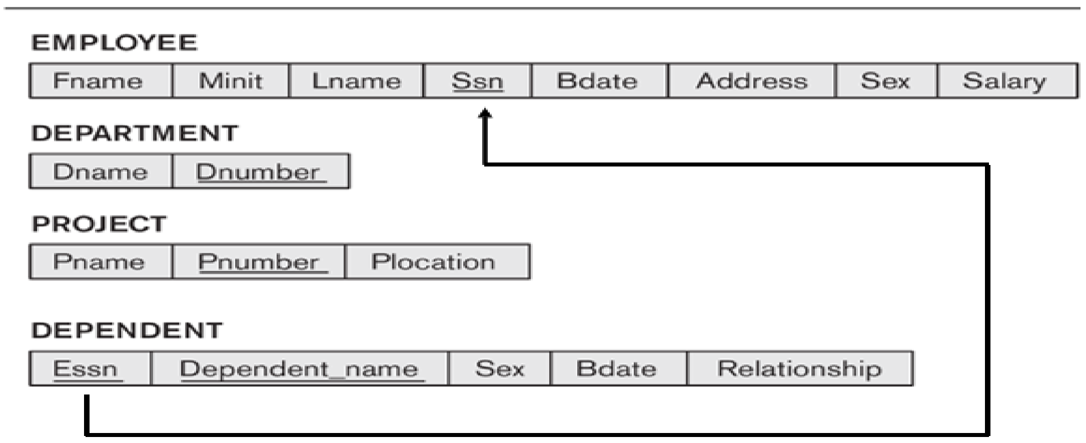
DEPARTMENT

| Dname | Dnumber |
|---|---|

PROJECT

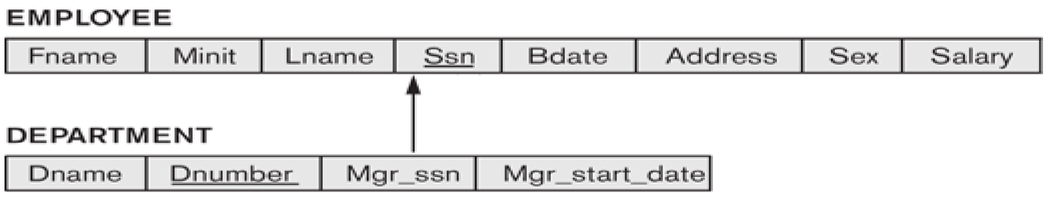
| Pname | Pnumber | Plocation |
|---|---|---|

## 1.2. Weak Entity Sets Tables

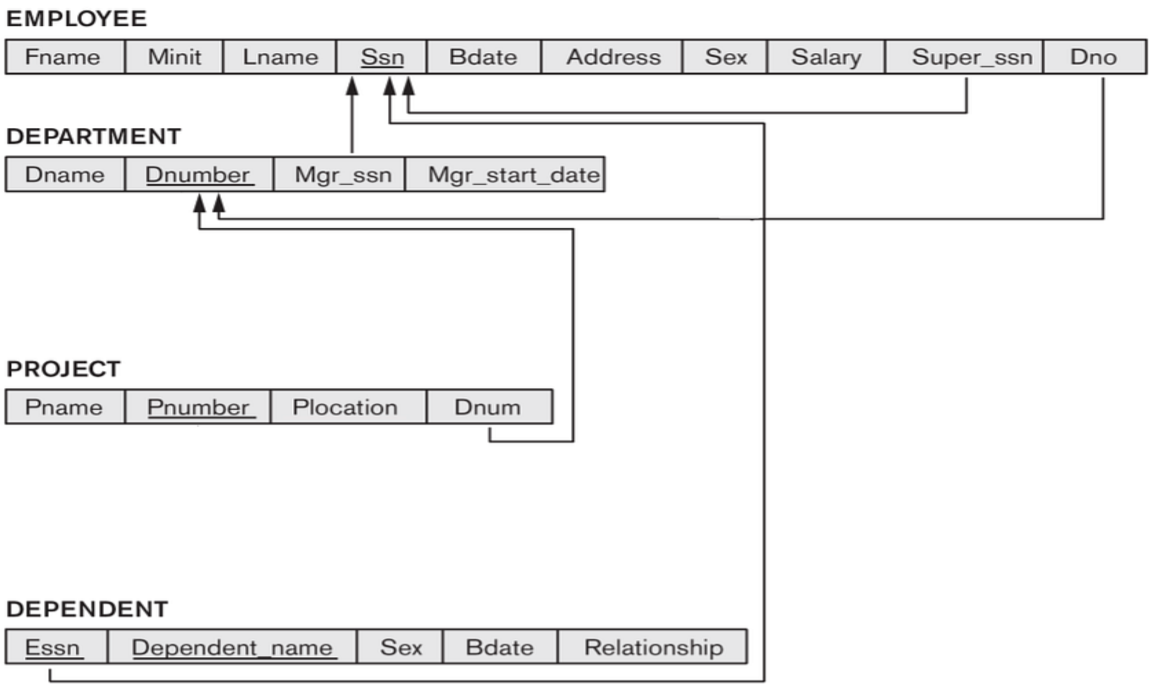


## 2. Relationships (as Foreign Keys)

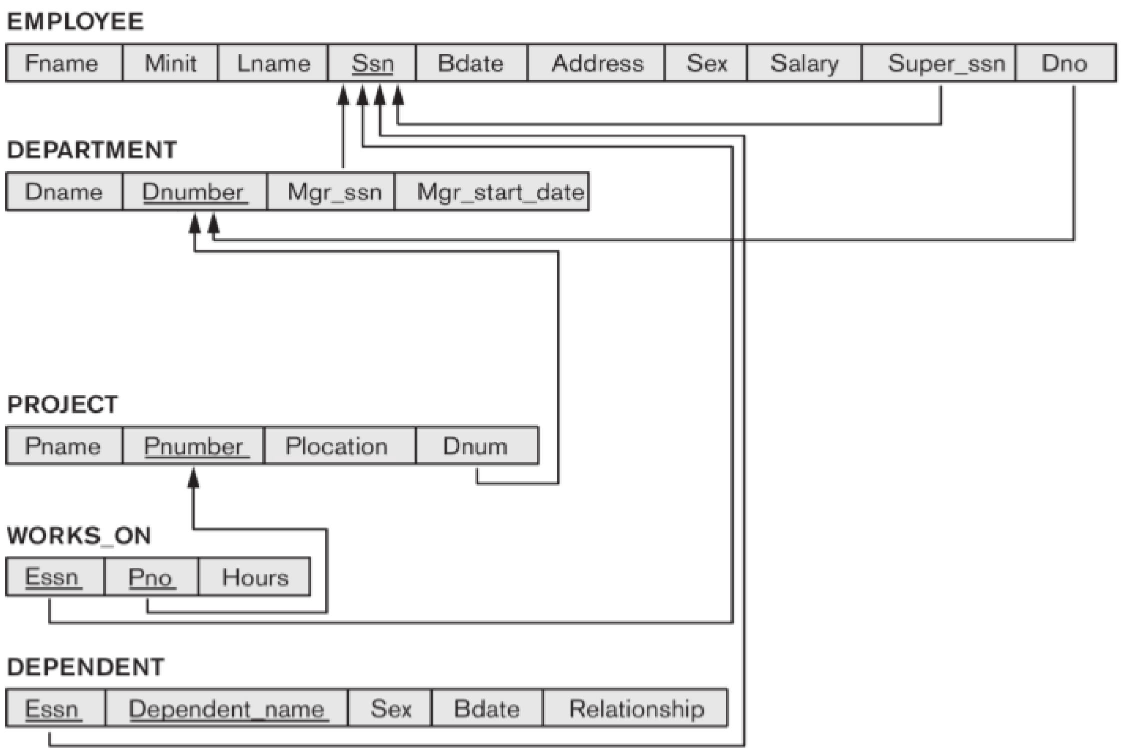
### 2.1 One-to-One Relationship



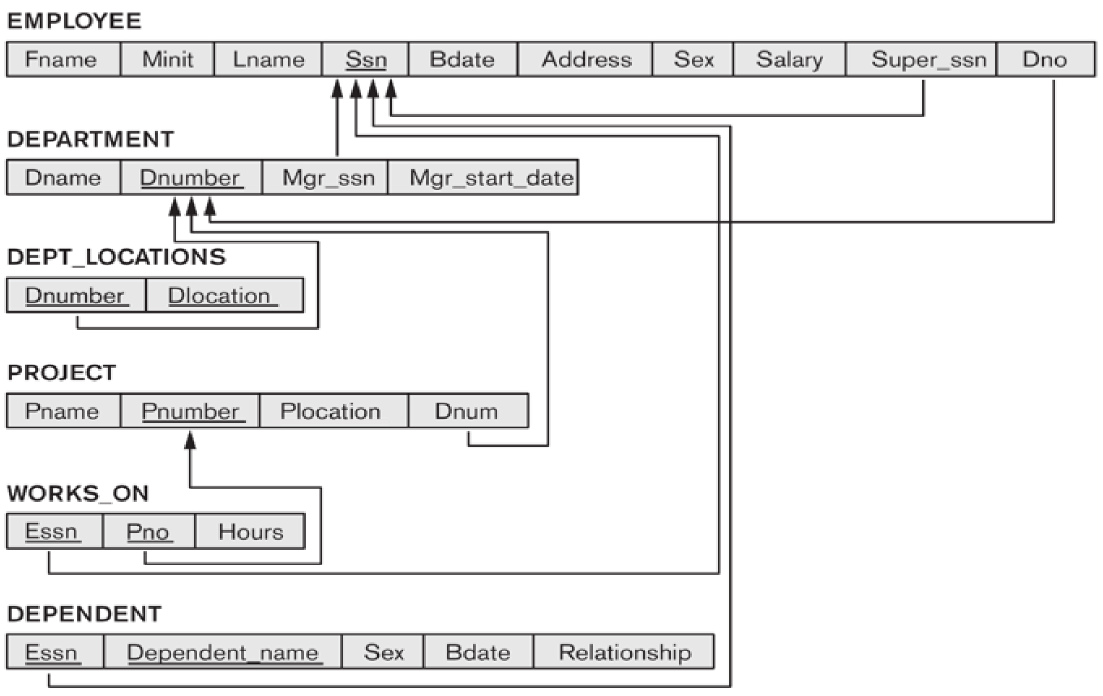
### 2.1 One-to-Many Relationship



## 2.1Many-to-Many Relationship



## 3. Multivalued Attributes (Separate Table)



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Hurray, we have successfully mapped the ER-Diagram of the Company Database to its Relational Schema. Just follow these 6 steps to successfully map any ER-Diagram to its Relational Schema.